DISPOSABLE DIAPER

BACKGROUND OF THE INVENTION

This invention relates to a disposable diaper having a high ventilation property.

A disposable diaper described in Japanese Utility Model Application Disclosure Gazette (Kokai) No. Sho64-18105 includes a pair of air-permeable and liquid-resistant barrier flaps formed on a pair of transversely opposite side flaps so as to elastically extend in a longitudinal direction of the diaper.

Japanese Patent Publication Gazette (Kokai) No. Hei4-55072 discloses a method for making a backsheet used in a disposable diaper, particularly to obtain such backsheet made of an air-permeable and liquid-impermeable plastic film.

In these Gazettes, the term "air-permeable and liquid-resistant" and the term "air-permeable and liquid-impermeable" are synonymously used. These known techniques may be adopted to improve a ventilation property of the foregoing barrier flaps and portions of a diaper backsheet in the proximity of the barrier flaps intended to surround the wearer's legs and thereby to alleviate undesirable stuffiness during use of the diaper.

The diaper proposed by the above-mentioned techniques will necessarily enlarge a diameter of each aperture formed in the barrier flaps and/or the backsheet in order to improve the air-permeability in these barrier flaps and/or backsheet. However, such measure may cause the desirable liquid-impermeability required for the barrier flaps and/or the backsheet. In other words, the conventional techniques have an antimonic relationship between improvement of the air-permeability and improvement of the liquid-impermeability.

SUMMARY OF THE INVENTION

In view of the problem as has been described above, it is an object of the invention to provide a disposable diaper having both a relatively high air-permeability and a relatively high liquid-impermeability.

According to the invention, there is provided a disposable diaper comprising a liquid-permeable topsheet, a liquid-impermeable backsheet and a liquid-absorbent core disposed therebetween so as to form a front waist region, a rear waist region and a crotch region extending therebetween, longitudinally opposite front and rear end flaps and transversely opposite side flaps which are formed by portions of the topsheet and the backsheet extending outward from

peripheral edges of the absorbent core, each of barrier cuffs which is elastically extendable in a longitudinal direction of the diaper being bonded, in an extended condition, to an inner surface of each of the side flaps; each of the barrier cuffs having longitudinally opposite front and rear ends, and inner and outer side edges extending in parallel to each other between the front and rear ends; the front and rear ends of each of the barrier cuffs being bonded to each of the end flaps; each of the barrier cuffs having, in the crotch region, the outer side edge bonded to the side flap in the proximity of the outer edge and the inner side edge bonded to the side flap along a line defined between the outer side edge and a side edge of the absorbent core; each of the barrier cuffs having a dimension between the outer and inner side edges selected to be larger than a dimension of the side flap between the outer and inner side edges of the barrier cuffs so that a contraction of each of the barrier cuffs in the longitudinal direction of the diaper causes an inner surface of the barrier cuff to be spaced from the inner surface of the side flap at least in the crotch region and thereby a hollow space being formed between the barrier cuff and the side flap; and portions of the barrier cuff and the side flaps participating in the formation of the hollow

spaces being air-permeable.

According to a preferred embodiment of the invention, elastic members are bonded, in an extended condition, in the longitudinal direction of the diaper, to each of the barrier cuffs in a zone thereof extending between the outer and inner side edges thereof rather adjacent the outer side edge thereof and thereby the barrier cuff is made elastically stretchable in the longitudinal direction of the diaper.

According to another preferred embodiment of the invention, the barrier cuffs and the side flaps are made of an air-permeable and liquid-impermeable material.

According to still another preferred embodiment of the invention, each of the barrier cuffs has a dimension between the outer and inner side edges thereof being 1.2 ~ 2.0 times of a dimension of the side flap similarly between the outer and inner side edges thereof.

The disposable diaper according to the invention is characterized by a unique arrangement such that leak of body fluids can be double-blocked by the pair of barriers cuffs and the pair of side flaps at least in the crotch region of the longitudinal three regions, i.e., the front waist region, the rear waist region and the crotch region extending between the former two regions. This arrangement allows the air-

permeability to be adjusted to relatively high levels in barrier cuff as well as in the side flaps. Each hollow space defined in the crotch region by each barrier cuff and the side flap associated with this barrier cuff has its inner volume which is variable depending on a movement of the diaper. More specifically, vapor-containing air staying within the diaper is expelled to the exterior of the diaper or dry air is sucked from the exterior into the diaper depending on the movement of the diaper. In this manner, a problem of stuffiness from which the wearer would suffer can be effectively solved.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing an embodiment of a disposable diaper according to the invention as partially broken away;

Fig. 2 is a sectional view taken along a line II - II in Fig. 1;

Fig. 3 is a sectional view taken along a line III - III in Fig. 1; and

Fig. 4 is a view similar to Fig. 2 showing an alternative embodiment of the diaper according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Details of a disposable diaper provided according to the invention will be more fully understood from the following description with reference to the accompanying drawings.

Disposable diaper 1 shown by Fig. 1 in a perspective view as partially broken away comprises a liquid-permeable topsheet 2, a liquid-impermeable backsheet 3 and a liquid-absorbent core 4 disposed between these two sheets 2, 3. These sheet 2, 3 and absorbent core 4 forms a front waist region 6, a rear waist region 7 and a crotch region 8 longitudinally extending between these two regions 6, 7. The absorbent core 4 is in a shape of rectangle or hourglass which is relatively larger longitudinally of the diaper 1. Portions of the topsheet 2 and the backsheet 3 extending outward beyond peripheral edges of the absorbent core 4 are placed upon each other and bonded together by means of hot melt adhesive (not shown) so as to form longitudinally opposite front and rear end flaps 11, 12 and transversely opposite side flaps 13. In the front and rear waist regions 6, 7, each of the side flaps 13 extend outward to form front and rear wings 13A, 13B, respectively. Each of the side flaps 13 is formed on an inner surface thereof with a barrier

cuff 14 extending along the crotch region 8 and partially into the front and rear waist regions 6, 7. The barrier cuff 14 is provided with a plurality of elastic members 29 extending longitudinally thereof. The front and rear end flaps 11, 12 are provided between the topsheet 2 and the backsheet 3 with elastic members 16, 17 extending circumferentially of the respective waist regions 6, 7. The elastic members 16, 17 are secured, in an extended condition, to an inner surface of at least one of the topsheet 2 and the backsheet 3. A pair of tape fasteners 16 are attached to the respective wings 13B of the rear waist region 7 in the vicinity of side edges thereof.

Fig. 2 is a sectional view taken along a line II-II in Fig. 1. The barrier cuff 14 is made of an air-permeable sheet and comprises, as seen transversely of the diaper 1, an outer side edge 23 bonded to an inner surface of the side flap 13 along an outer edge 20 thereof by means of hot melt adhesive 22a and an inner side edge 26 bonded to an inner surface of the side flap 13 along an intermediate zone between the outer side edge 23 and a side edge 24 of the absorbent core 4. The barrier cuff 14 further comprises longitudinally opposite front and rear ends 27, 28 (See Fig. 1) bonded to the respective end flaps 11, 12 of the front and

rear waist regions 6, 7. The barrier cuff placed upon the side flap 13 has a plurality of elastic members 29 secured, in an extended condition in the longitudinal direction, to the inner surface of the side flap 13 by means of hot melt adhesive (not shown).

The barrier cuff 14 has a transverse dimension A between the outer and inner side edges 23, 26 and the side flap 13 has a transverse dimension B similarly between the two side edges 23, 26. The dimension A is preferably 1.2 ~ 2.0 times, more preferably 1.3 ~ 1.7 times of the dimension B which is, in turn, preferably in a range of 15 ~ 90 mm. Referring to Fig. 2, the elastic members 29 of the barrier cuff 14 are designated by reference numerals 29A ~ 29E. Of the elastic members 29A ~ 29E, the outermost elastic member 29A longitudinally extending adjacent the outer side edge 23 has the highest extension stress and the innermost elastic member 29E longitudinally extending between the outer side edge 23 and the inner side edge 26 has an extension stress equal to or less than the extension stress of the elastic member 29A. The elastic members 29B ~ 29D interposed between the two elastic members 29A, 29E respectively have an extension stress equal to or less than the extension stress of the elastic member 29E. The number of the elastic members

29B, ~ 29D to be interposed between the elastic members 29A, 29E is not limited to the number used in the embodiment of Fig. 2 and may be selectively increased or decreased without departing from the scope of the invention. When the diaper 1 is inwardly curved along a longitudinal axis thereof with the topsheet inside as shown in Fig. 1, contraction of the elastic members 29 causes the inner surface of the barrier cuff 14 to be moved away from the inner surface of the side flap 13. Consequently, the barrier cuff 14 cooperates with the side flap 13 to form a hollow space 31. In a state of the barrier cuff 14 having thus formed the hollow space 31, a wall section of the barrier cuff 14 defined between the elastic member 29A and the elastic member 29E is substantially flat and a wall section C of the barrier cuff 14 defined between the elastic member 29E and the inner side edge 26 is forced by the absorbent core 4 to extends downward because the absorbent core 4 is lowered as the diaper 1 is curved inwardly. The side flap 13 extends obliquely between the outer side edge 23 and the inner side edge 26 of the barrier cuff 14, as seen in Fig. 2.

The barrier cuff 14 serving as an important component of the hollow space 31 comprises the air-permeable sheet as previously mentioned. On the other hand, the backsheet 3 is

formed with a plurality of air-permeable apertures 32 and the topsheet 2 placed upon the backsheet 3 is also air-permeable and liquid-permeable. Thus, a portion of the side flap 13 serving as another component of the hollow space 31 and comprising the topsheet 2 and the backsheet 3 is also air-permeable. Accordingly, the substantially entire peripheral wall defining the hollow space 31 is air-permeable.

Fig. 3 is a sectional view taken along a line III-III in Fig. 1. As shown, the hollow space 31 is collapsed in the vicinity of the longitudinal ends of the front and rear waist regions 6, 7, respectively. In the vicinity of the longitudinal ends of the front and rear region 6, 7, the barrier cuff 14 is bonded to the upper surface of the topsheet 2 and, at the same time, layers of the barrier cuff 14 folded one upon another are bonded together by means of hot melt adhesive 22c.

With the diaper 1 of such construction being put on a wearer, the relatively flat wall of the barrier cuff 14 extending between the elastic member 29A and the elastic member 29E is normally placed against a crotch zone or around the legs of the wearer. In this state, the wall section C and the side flap 13 of the barrier cuff 14 extend downward so as to cooperate with the relatively flat wall to define

the hollow space 31. Depending on a posture taken by the wearer, the absorbent core 4 may move upward into close contact with the wearer's crotch zone, collapsing the hollow space 31 and thereby decreasing its inner volume. However, the hollow space 31 restores again its full inner volume shown in Fig. 2 as the absorbent core 4 downward moves away from the wearer's crotch zone. As the inner volume of the hollow space 31 decreases, vapor-containing air staying within the hollow space 31 as well as stuffy air in the diaper 1 is expelled to the exterior through the air-permeable barrier cuff 14 and the air-permeable side flap 13. On the contrary, as the inner volume of the hollow space 31 increases, external dry air is sucked through the barrier cuff 14 and the side flap 13 to the interior of the diaper 1.

With such diaper 1, an amount of body fluids flowing sideways over the crotch region 8 is blocked by the barrier cuff 14. Even if the amount of body fluids flowing sideways has partially penetrated the barrier cuff 14 into the hollow space 31, such amount of body fluid is then prevented by the side flap 13 from further flowing sideways into the exterior of the diaper 1. In this manner, the amount of body fluids which otherwise might leak sideways over the crotch region 8 can be double-blocked and this feature allows air-

permeability of the barrier cuff 14 as well as of the side flap 13 to be adjusted to a relatively high value.

Fig. 4 is a view similar to Fig. 2 showing an alternative embodiment of the invention. This specific embodiment of the diaper 1 is similar to that of Fig. 2 except a configuration of its side flaps 13. The side flap 13 shown in Fig. 4 comprises the topsheet 2 largely extending beyond the side edge 24 of the absorbent core 24, the backsheet 3 slightly extending beyond the side edge 24, and an extension sheet 36 bonded to an outer end of the extended backsheet 3 by means of hot melt adhesive 22. The topsheet 2, backsheet 3 and extension sheet 36 are placed one upon another and/or overlapped one by another and bonded together along predetermined zones utilizing lines of hot melt adhesive 22e, 22f, 22g. Each extension sheet 32 extends not only along the side edge of the crotch region 8 but also along respective side edges of the front and rear waist regions 6, 7 to their longitudinal ends. Preferably, the extension sheet 36 has an air-permeability higher than that of the backsheet 3.

To exploit the invention, a liquid-permeable nonwoven fabric or a liquid-permeable apertured plastic sheet may be employed as material for the topsheet 2. Such nonwoven

fabric preferably has a basis weight of 10 ~ 50 g/m^2. The backsheet 3 is made of a plastic sheet, more preferably of air-permeable and liquid-permeable plastic sheet. The portion of the backsheet 3 participating in formation of the hollow space 31 may be formed with a plurality of apertures 32 each having a diameter of 0.1 ~ 2 mm at a total aperture area ratio of 2 ~ 10 % with respect to an entire area of the foresaid portion in order to improve its air-permeability. The air-permeable sheet as the important component of the barrier cuff 14 may be made of an air-permeable nonwoven fabric having a basis weight of 10 ~ 100 g/m^2. The barrier cuff 14 may be double-layered as in the embodiments shown, but the barrier cuff 14 may be realized also in the form of a single-layered sheet. According to the embodiments shown, the portions of the topsheet 2 and the backsheet 3 participating in formation of the hollow space 31 are placed upon each other. Such arrangement ensures that, even if the apertures 32 of the backsheet 3 are of relatively large diameter, body fluids can be effectively prevented from leaking through the apertures 32. If it is unnecessary to provide the backsheet 3 with those apertures 32 for improvement of its air-permeability, the topsheet 2 may be bonded to the inner side edge 26 of the barrier cuff 14 and

terminated at this bonding line without further extending into the hollow space 31. Nonwoven fabrics employed as material for the topsheet 2, the backsheet 3 and the extension sheet 36 may be locally treated to provide them with hydrophilic or hydrophobic nature, so far as they have zones requiring such treatment.